

Ohio State University

Contact: Mo Samimy (samimy.1@osu.edu)

We used simultaneous noise measurements using two microphones in the far field and flow visualizations using laser sheet lighting in an attempt to identify noise sources (e.g. interaction among turbulence structures) in a Mach 1.3 ideally expanded jet. Figure 1 shows two time traces of the normalized sound pressure that was recorded by the front microphone of the dual microphone array. The time trace of the pressure ratio in Figure 1(a) shows a sinusoidal signal between 1.5 and 2.5 ms with a period of approximately 0.3 ms that lasts for three periods of the oscillation. In addition to groups of oscillating, large amplitude, seemingly related peaks, there were also individual large amplitude peaks. Figure 1(b) shows such an example of a large amplitude sound pressure ratio peak. The large peak is not a crackle-type noise, as the Mach number is too low, and the skewness of the data was below 0.1. Also in Figure 1(b), the time range from 1.0 to 2.0 ms for the front microphone has no large amplitude pressure ratio peaks. This is a large period of time without any significant sound events (a large-scale structure would travel nearly 8 jet diameter distance over this time period). There is also a similar period of relative quiet between 2.5 and 3.1 ms. Regions that did not have any large-amplitude sound waves over long periods were observed in many of the other time traces.

The goal of this portion of the research was to relate these noise events to flow processes. However, visualizations based on a double-pulse laser proved to be inadequate. Currently we are in the process of developing a laser and a camera system that we can use to obtain up to 16 pulses and thus 16 consecutive images with an inter-image time separation as small as 1 microsecond. This system will be ready in a month and we are hoping to utilize it for the identification of flow processes that generate the noise events shown in Figure 1.

